

WHAT IS CLAIMED IS:

1. A scanning electron microscope comprising:

an electron source;

a first focusing lens for focusing a primary electron beam emitted from said electron source;

an object lens diaphragm for removing an unnecessary region of the primary electron beam focused by said first focusing lens;

a second focusing lens for focusing the primary electron beam that has passed through said object lens diaphragm;

an object lens for focusing the primary electron beam focused by said second focusing lens on a sample;

a deflecting means for the scanning of the sample by the primary electron beam;

a secondary electron detector for detecting a secondary electron emitted from the sample due to electron beam irradiation; and

an X-ray detector for detecting an X-ray emitted from the sample;

wherein said scanning electron microscope has a function of focusing the primary electron beam on the sample by using said object lens when the magnification of an image to be scanned is higher than a preset value (high-

magnification mode),

wherein said scanning electron microscope has a function of focusing the primary electron beam on the sample by using said second focusing lens when the magnification of an image to be scanned is lower than a preset value (low-magnification mode), and

wherein, in said low-magnification mode, either a first low-magnification mode in which the exciting current of said object lens is set to be a constant value independently of the accelerating voltage of the primary electron beam or a second low-magnification mode in which the exciting current of said object lens is changed as a function of the accelerating voltage of the primary electron beam is selected.

2. A scanning electron microscope as claimed in claim 1, wherein said sample is placed in the magnetic field of said object lens.

3. A scanning electron microscope as claimed in claim 1, wherein said first low-magnification mode sets the exciting current of said object lens to be zero or in a weak excitation state.

4. A scanning electron microscope as claimed in claim 1, wherein said first low-magnification mode sets the exciting current of said object lens to be either the minimum exciting current of said object lens that does not

lower the efficiency of secondary electron detection or the exciting current of said object lens that provides the maximum view for the observation magnification.

5. A scanning electron microscope as claimed in claim 1, wherein the exciting current of said object lens in said second low-magnification mode is set to be in proportion to the square root of the accelerating voltage of the primary electron beam.

6. A scanning electron microscope as claimed in claim 1, wherein switching between said first low-magnification mode and said second low-magnification mode is performed automatically according to the set value of observation magnification.

7. A scanning electron microscope as claimed in claim 1, wherein said scanning electron microscope has storage means that each store setting values of brightness and contrast of said sample image independently for said high-magnification mode, said first low-magnification mode, and said second low-magnification mode, and according to switching to each of said magnification modes, the setting values of brightness and contrast for each of said magnification modes are automatically set to be the values stored in said storage means.

8. A scanning electron microscope as claimed in claim 1, wherein said deflecting means controls the

scanning direction of said primary electron beam according to switching between said high-magnification mode, said first low-magnification mode, and said second low-magnification mode.

9. A scanning electron microscope as claimed in claim 8, wherein said deflecting means controls the scanning direction of said primary electron beam in such a way that the scanning direction of said primary electron beam on said sample substantially corresponds to the X direction of a sample stage on which said sample is mounted.

10. A sample observation method by means of a scanning electron microscope, comprising the steps of:

focusing a primary electron beam on a sample by using a focusing lens when the magnification of an image to be scanned is lower than a preset value;

setting the exciting current of an object lens to be a constant value for weak excitation independently of the accelerating voltage of said primary electron beam; and

switching the exciting current of the object lens to zero when the scanned image of the sample is to be recorded.

11. A sample observation method by means of a scanning electron microscope, comprising the steps of:

focusing a primary electron beam on a sample by using a focusing lens when the magnification of an image to be scanned is lower than a preset value; and

changing the exciting current of an object lens as a function of the accelerating voltage of said primary electron beam to observe the X-ray mapping image of said sample.

12. A scanning electron microscope comprising:

an electron source;

a first focusing lens for focusing a primary electron beam emitted from said electron source;

an object lens diaphragm for removing an unnecessary region of the primary electron beam focused by said first focusing lens;

a second focusing lens for focusing the primary electron beam that has passed through said object lens diaphragm;

an object lens for generating a magnetic field at the position of a sample and for focusing the primary electron beam focused by said second focusing lens on the sample;

an electron beam deflecting means for the scanning of the sample by the primary electron beam; and

an X-ray detector for detecting an X-ray emitted from the sample due to electron beam irradiation;

whereby an X-ray mapping image of the sample is obtained,

wherein the primary electron beam is focused on the

sample by said object lens to perform scanning when the magnification of an image to be scanned is higher than a preset value, and

the primary electron beam is focused on the sample by said second focusing lens to perform scanning when the magnification of an image to be scanned is lower than a preset value, and

wherein the exciting current of said object lens is set to be in a weak excitation state to prevent the incidence of a reflected electron from the sample on said X-ray detector.

13. A scanning electron microscope as claimed in claim 12, wherein if the magnification of said image to be scanned is lower than the preset value, the exciting current of said object lens is changed in proportion to the square root of the accelerating voltage of the primary electron beam.